



STATE OF TENNESSEE
DEPARTMENT OF ENVIRONMENT AND CONSERVATION
DIVISION OF UNDERGROUND STORAGE TANKS

COMPLIANCE GUIDANCE DOCUMENT – 107
TECHNICAL CHAPTER 3.3
STATISTICAL INVENTORY RECONCILIATION (SIR)

Formatted: Centered

EFFECTIVE DATE - ~~July 29, 1996~~TBD
~~(DRAFT REVISION DATE – 03/04/2011)~~
~~(DRAFT REVISION DATE – 08/25/2011)~~05/18/2012

REQUIREMENTS FOR STATISTICAL INVENTORY RECONCILIATION (SIR)

PURPOSE

~~The purpose of this guidance document is to assist Division of Underground Storage Tanks (Division) staff and the regulated community in understanding the regulatory requirements of Statistical Inventory Reconciliation (SIR) and provide guidance on acceptable practices for using this method of leak detection. The purpose of this guidance document~~technical chapter ~~is to assist tank owners and operators, service providers, and Division of Underground Storage Tanks (Division) staff in understanding the regulatory requirements of Statistical Inventory Reconciliation (SIR) and provide guidance on acceptable practices for using this method of leak detection. It will describe SIR practices for the tank owner and SIR vendor and will serve as a guide for inspectors.~~

This ~~Compliance Guidance Document (CGD)~~technical chapter contains the current policy of the Division based on the statute and regulations governing the Tennessee Petroleum Underground Storage Tank program. This document supersedes all previously published versions, ~~and may be amended from time to time without advance notice to the regulated community as regulatory amendments or policy changes warrant.~~ The most current version of this ~~guidance document~~technical chapter will be posted and always available on the Division's website.

AUTHORITY

All rules referred to in this ~~CGD~~technical chapter are contained in Chapter ~~1200-1-15~~0400-18-01 and are available on the Division of Underground Storage Tanks website at <http://www.tn.gov/sos/rules/0400/0400-18/0400-18-01.20120307.pdf>~~http://www.tn.gov/sos/rules/1200/1200-01/1200-01-15.20110202.pdf~~

~~The UST Board is currently revising its rules to renumber them following chapters assigned to the Department of Environment and Conservation. The new chapter will be 0400-18-01 when the renumbering is adopted and a link to the renumbered chapter will be on the Division's website referenced above.~~

APPLICABILITY

SIR can be used on all petroleum underground storage tank* (UST)* and/or piping systems installed prior to July 24, 2007 as the primary method of leak detection (interstitial monitoring is required for tanks or piping installed on or after July 24, 2007). SIR monthly monitoring leak detection results include the product

piping; however a means of catastrophic line leak detection such as a mechanical or electronic line leak detectors is also required on all pressurized piping **by rules .04(2)(b)1.(i) and .04(4)(a)** when SIR is used for monthly monitoring.

SIR may only be used as a method of monthly monitoring, and may not be used as a method of tank or line tightness testing **as outlined in rules .04(3)(c) and .04(4)(b).**

INTRODUCTION

SIR is performed using computer software that analyzes daily inventory, delivery, and daily dispensing data collected over a period of time (not to exceed thirty (30) days) to determine if the UST system is leaking. Each operating day, product level measurements are made using a gauge stick or an electronic device such as an automatic tank gauge **as required by rule .04(3)(h)1.** The owner/operator shall keep complete records of all dispensing, and delivery data.

There are companies (“SIR vendors”) that specialize in performing SIR. If one of these companies is used by a tank owner/operator, then the tank owner/operator will typically submit the applicable SIR data to that company at the beginning of each month following data collection. That data is analyzed by ~~that company a~~ SIR vendor and a report of the results is sent to the tank owner/operator. As an alternative, there are some SIR vendors that make versions of their SIR program available as packaged software that may be operated by trained person on a personal computer. Such systems are sometimes referred to as “stand alone” SIR systems and are designed to conduct a SIR evaluation of the data entered by the owner/operator without the assistance of an outside SIR data analyst. Owners/operators who use “stand alone” SIR systems may not make modifications to the software and may only operate the system as designed and are precluded from doing anything that will alter the sensitivity of the method, or affect the probability of detection or probability of false alarm. Any programming modifications or software upgrades that affect the probability of detection (Pd) or probability of false alarm (Pfa) must be done by the SIR method developer or current SIR method owner.

In some cases, a SIR vendor may have licensed a local company (licensee) to operate their SIR program in lieu of sending data directly to the SIR vendor’s home office. Under those arrangements, only persons adequately trained in data analysis by the SIR vendor should have the ability to engage in any data screening or monthly SIR result determination when operating the SIR program.

DEFINITIONS

Calculated Leak Rate may be called “leak rate” or “estimated leak rate”, and is a calculated number that determines the difference from zero (0) gallons per hour (gph). To make a SIR determination, the leak rate is compared to the threshold. If the calculated leak rate for the SIR data exceeds the threshold, then the SIR report should indicate a “fail”; however, if it is less than the threshold it is a “pass”. SIR vendors using quantitative methods must report **calculated leak rates** in SIR results. SIR vendors using qualitative methods are only required to report results as “pass” or fail”. ~~Qualitative methods calculate~~ Qualitative methods *calculate* leak rates and compare them to a threshold, but they do not provide them on SIR reports. Few vendors use qualitative SIR methods.

Calculated leak rates may be reported with a positive or negative sign before them, and some results may be reported as a “gain” or “gaining trend”. A gain could be due to thermal product expansion, measurement error, or possibly water intrusion. Regardless if the calculated leak rate is positive or negative, if the calculated leak rate is greater than the threshold, then the SIR result should be declared a “fail” and Division rules require it be treated as a suspected release.

Inconclusive means the data quality will not provide a conclusive result conforming to the 95% probability of detection (Pd) and no more than 5% probability of false alarm (Pfa) criterion. An inconclusive may be caused by several conditions and does not mean that a UST system is leaking; it simply means that the data

are of inferior quality and a conclusive determination is not possible. Owner/operators must investigate the causes of inconclusive results. Most SIR vendors have a procedure for use in investigating inconclusive results, and many times a vendor can advise tank owners why the results were inconclusive according to data characteristics. How owner/operators should handle inconclusive results is described in Division rules [.04\(3\)\(h\)7](#), and in this [EGD technical chapter](#).

Leak Threshold (sometimes called “threshold”). This is the reference point the SIR method uses to declare a “pass” or “fail”.

- If the calculated leak rate is **greater than** the threshold (0.1 gph ~~according to Division rules~~), then the correct SIR result would be a “fail” **according to rule .04(3)(h)4.(ii)**.
- If the calculated leak rate is **less than** the threshold, then the correct SIR result would be a “pass” **according to rule .04(3)(h)4.(i)**.

The threshold is determined in the Third Party evaluation, and in most cases it is set at ½ the Performance Standard. The reason for this is related to the Pd and Pfa. The Performance Standard for monthly monitoring is 0.2 gph, so the threshold for most monthly SIR methods is 0.1 gph. If the calculated leak rate is more than 0.1gph, the SIR vendor shall declare a “fail” as required by rule .04(3)(h)4.(ii).

A few SIR vendors are listed on the National Work Group on Leak Detection Evaluations (NWGLDE) List that use a “floating” threshold. The floating (or dataset) threshold can be **greater than** 0.1gph, however, ~~Tennessee rules specify that a “fail” must be declared if the calculated leak rate is greater than 0.1gph. If a~~ SIR vendor uses a floating threshold greater than 0.1 gph, and if the calculated leak rate exceeds 0.1 gph for that month, then the SIR result shall be a “fail” for that month, **as required by rule .04(3)(h)4.(ii)**, even if the calculated leak rate is less than the floating threshold.

Minimum Detectable Leak Rate (MDL) is a measure of data quality and varies according to monthly raw data. The monthly raw data is often called a dataset. Each dataset is unique and data quality can vary from very good to very poor. When a SIR vendor determines the MDL for a given data set, he is determining the *smallest* leak that can reliably be detected at the 95% Pd and 5% Pfa level **as required by rule .04(1)(a)**. The MDL is a screening technique which determines if the data is acceptable ~~for a~~ monthly SIR analysis. The MDL of the dataset is compared to the Performance Standard as follows:-

- If the MDL **is less than** the Performance Standard (0.2 gph), the dataset is valid for monthly SIR analysis.
- If the MDL **is greater than** the Performance Standard (0.2 gph), the data may be analyzed, however the SIR result is not valid for monthly SIR analysis, since the data does not meet the Performance Standard at the 95% Pd and 5% Pfa confidence level **required by rule .04(1)(a)3**.

When the MDL is greater than the Performance Standard, some SIR vendors may simply issue an inconclusive for that dataset, and not report a calculated leak rate since the SIR result will not be valid.

Performance Standard is the criterion that the method must meet for it to be used for leak detection. It is 0.2 gph for monthly monitoring. Any SIR method that cannot meet this standard is not acceptable for leak detection. A Third Party evaluator subjects the SIR method to a series of tests according to a specific approved protocol. If the method does not pass the Third Party evaluation certifying its ability to detect a leak of a specified size, then it cannot be listed on the NWGLDE List.

Probability of Detection (Pd) and Probability of False Alarm (Pfa) are performance standards established in ~~regulation rule .04(1)(a)3~~, which all leak detection methods must meet to be considered acceptable as valid UST methods. The Pd for all leak detection methods must be at least 95%, which is another way of saying that the method is capable of detecting leaks of 0.2 gph 95 out of 100 times. A Pfa of no more than 5% means that false alarms should not happen more than five times in a hundred. This is sometimes referred to

as the 95/5 confidence level. The Pd and Pfa are a quality measure that helps insure that the leak of a specified size is not missed, and that the method is not declaring tight tanks to be failing.

REQUIREMENTS

All SIR methods must be able to detect a leak of at least 0.2 gallons per hour (gph). All SIR methods must have a probability of detection (Pd) of at least 95% with a probability of false alarm (Pfa) of no more than 5% **as required by rule .04(1)(a)3**. SIR methods are ~~third-Third party-Party~~ evaluated to determine if the method meets the above criteria. Methods that meet the criteria are placed on a list maintained by the National Work Group on Leak Detection Evaluations (NWGLDE) which is posted on their website at www.nwglde.org. The methods published on the website will always be current and will be acceptable to use for leak detection as long as they are properly applied. Any method not appearing on the website has not been properly evaluated and will not be acceptable to the Division as a valid leak detection method. The NWGLDE ~~will~~ only lists SIR methods, not individual licensees of the methods.

SIR is a method of monthly monitoring allowed by rule .04(3)(h), therefore a SIR report must be generated each month as required by the rules .04(3)(h)2. Merely collecting monthly raw data and saving it for submission to a SIR vendor for data analysis at a future date is not monthly monitoring and is a violation of UST rules. Data collected from any prior month(s) may not be used in deriving the monthly SIR result. See rule .04(3)(h)5, and 6. In addition, the SIR raw data must be analyzed by SIR software at the beginning of the next month following data collection. A report of the results of data analysis shall be generated by the tenth day of that month as required by rule .04(3)(h)2.

There is a capacity limitation for SIR use on single tanks. These limitations may be found on the NWGLDE website and in Appendix 1 of this [CGD Technical Chapter](#).

SIR may be used on manifolded UST systems as long as the total capacity of the manifolded system does not exceed the capacity for which the method was approved. If the capacity of the manifolded system exceeds the listed capacity, another method of leak detection must be used. If a SIR method has been evaluated according to the NWGLDE SIR Manifold Tank Protocol Addendum, then the capacity limitations on the NWGLDE website will apply for single **and** manifolded tanks. If SIR is used on manifolded systems, then there will only be a single SIR result for all tanks that are manifolded.

Where SIR is used on a UST system with a blending valve in a multi-product dispenser (MPD), the number of SIR results will correspond to the number of products being blended. For example, if there is regular, mid-grade and premium gasoline at a facility, there should be a SIR result for regular and premium, even though the facility is selling three grades of gasoline.

If a SIR vendor requires more than one (1) month of data for initial evaluation, another method of monthly release detection shall be conducted during that period **as required by rule .04(3)(h)5**.

SIR methods may be **quantitative** or **qualitative**. A **quantitative** test reports results in terms of a numerical leak rate based on characteristics of the dataset. A **qualitative** test reports results as pass or fail based on a comparison of dataset characteristics with a predetermined threshold. ~~Tennessee UST Rules .04(3)(h)4.(ii) specify specifies~~ **that** 0.1gph as the threshold for determining a “fail”, so vendors whose methods use a moving or “floating” threshold may not declare a pass if the calculated leak rate exceeds 0.1gph, regardless of the threshold listed on the NWGLDE website. This threshold applies to both qualitative methods and quantitative methods.

~~Tennessee rules~~ Rule .04(3)(h)2.(i) requires that monthly SIR results include the raw data that was provided to the SIR vendor to generate the SIR result. For specific requirements, see the **RECORD KEEPING** section below.

~~Tennessee rules~~ Rule .04(3)(h)1, requires SIR data collection to be performed according to the requirements for inventory control, rule .04(3)(a), which include the following:

1. Inventory volume measurements for petroleum inputs, withdrawals, and the amount still remaining in the tank are recorded each operating day (for SIR purposes this is considered defined as to be any day the tank contains one inch or more of product is placed into or removed from the tank).
2. The equipment used to take daily inventory readings is in good state of repair and is capable of measuring the level of petroleum over the full range of the tank's height to the nearest one-eighth of an inch;
3. The petroleum inputs are reconciled with delivery receipts by measurement of the tank inventory volume before and after delivery;
4. Deliveries are made through a drop tube that extends to within one (1) foot of the tank bottom;
5. Product level measurements which are taken using a gauge stick shall be taken through a drop tube;
6. Petroleum dispensing is metered and recorded within the local standards for meter calibration or an accuracy of six (6) cubic inches for every 5 gallons of petroleum withdrawn;
7. Meters must be calibrated at least annually. If each dispenser does not have a Tennessee Department of Agriculture's Division of Regulatory Services (TDA-DRS) calibration sticker within the last 12 months, all dispensers at retail facilities must have meters calibrated by an individual certified by the TDA-DRS.

8. The measurement of any water level in the bottom of the tank is made and recorded to the nearest one-eighth of an inch at least once a month. Monthly water level measurements must be shown in the raw data.

8. Product level measurements are required to be collected each day that one inch or more of product is stored in the tank. This includes seasonal tanks, such as kerosene or tanks located at marinas (see the Atypical UST Systems document), tanks not in operation during holidays or extended absence by owner/operator, or tanks that are temporarily out of service.

Formatted: Indent: Left: 0.44", No bullets or numbering

Formatted: No bullets or numbering

Formatted: Font: Bold

CONTINUOUS IN-TANK LEAK DETECTION SYSTEMS

For high throughput locations which operate continuously, a leak detection alternative called Continuous In-Tank Leak Detection System (CITLDS) also known as Continuous Statistical Leak Detection (CSLD) is available. CITLDS uses an ATG to collect product level measurements, and employs three different techniques to generate results. Continual reconciliation utilizes statistical methods to determine a monthly monitoring result. All of these systems are designed to operate continuously while the tank is in normal operation.

These methods may use different techniques; however, they share the characteristic of monitoring tank data continuously for days, weeks, or months, and then providing leak detection capabilities on demand once the initial data requirements are met. These methods may use many data items, including product height, product temperature, presence or depth of water, the tank chart or tank geometry, meter readings, delivery records, etc, collected continually. The advantage of using CITLDS is that tank systems do not have to be taken out of service each month to conduct a static test.

Three techniques are described in the *Evaluation Protocol for Continuous In-Tank Leak Detection Systems Revision 1* dated January 7, 2000 as follows:

"Continuous Automatic Tank Gauging Systems (ATG)" systems use an ATG probe to collect data continually and combine this with software to identify time intervals when there is no activity in the tank and

the data are stable enough for analysis. An algorithm then combines data from a number of such periods until there is enough evidence to make a determination about the leak status of the tank. This type of system functions like an ATG except that it does not require that the tank be taken out of service for a set period of several hours whenever a test is to be performed. Instead, it uses data from shorter stable time periods and combines the results to estimate a leak rate and perform a test. The system may default to a standard or shut down ATG test (requiring the tank to be out of service for a few hours) at the end of the month if sufficient good quality data have not been obtained over the month.

Continuous ATG may use the same probe in a tank as a similar ATG to collect temperature and level measurements and report them to a console. However, whereas an ATG requires a specified waiting time after a delivery and a further period of no dispensing or delivery operations while it conducts a static test (a shut down period), the Continuous ATG is designed to avoid such specified shut downs of normal tank operation by collecting data continuously. The software identifies segments of stable data, stores these data, and combines numerous such segments to produce a leak rate estimate that is used to determine whether the tank is tight or not.

For high throughput tanks, a period of several days or weeks may be needed for the system to acquire sufficient data to make its determination. Once an adequate database is obtained, a test can be conducted at any time by owner/operator request. The test is based on the most recent data available. As new data are accumulated, older data are dropped, so that the leak rate estimate and test are based on the most current data. The total duration of the test period and the amount of data actually used in calculations will vary with the tank use pattern, the type of test being run (e.g., monthly or annual), and the quality of the current data.

"Continual Reconciliation" systems combine continuous product level and temperature monitoring data from the tank with data from dispensing meters. Data from delivery records may also be included. In addition, these systems may address leaks or unexplained losses of product from the tank vessel, the pressurized lines, or a combination to monitor the tank and line system. These systems allow a combination of monitoring data from a static tank and inventory data from a dynamic tank to be combined in monitoring the system for a leak.

Continual reconciliation systems are related to statistical inventory reconciliation (SIR) systems. However, while SIR uses daily inventory records in the statistical analysis, the continual reconciliation systems use much more frequent inventory data. In addition, the continual reconciliation system may use initial data to develop a meter map, identifying meters with the tanks they draw product from. Furthermore, the continual reconciliation system may use data from the first month or so of operation to perform a tank calibration for each specific tank, providing a more accurate analysis of the data. Thus, the continual reconciliation systems differ from SIR systems in that they collect data from the tanks automatically and analyze much more data more frequently.

Continuous ATGS and Continual reconciliation systems are listed under Continuous In-Tank Leak Detection Methods on the NWGLDE website, www.nwglde.org

"Automatic Monthly Inventory Control" systems, are designed to satisfy the EPA requirement for manual inventory of identifying a loss of 1% of monthly throughput plus 130 gallons by providing an automated way to acquire the data. These systems produce the required inventory reconciliation report, including calculation of the daily differences, the monthly reconciliation, and the comparison number of 1% of throughput plus 130 gallons. Reports produced from automatic monthly inventory control systems are intended to be business management tools while providing an automatic method of meeting daily inventory record and monthly inventory reconciliation requirements, but are not designed to be stand-alone leak detection methods. However, Automatic Monthly Inventory Control systems ~~These methods~~ are a moot issue in Tennessee, since Inventory Control is no longer allowed as a sole method of leak detection ~~in Tennessee~~.

CITLDS REPORTS

CITLDS reports will show only a single result for all tanks containing that product grade. For example, if a location has two ~~diesel tanks product tanks and which are two-manifolded diesel tanks~~, the CITLDS report will issue one result for the two diesel tanks. If the report is a 'fail' for the diesel product, then individual tank and/or line tightness tests will need to be conducted on each diesel UST system ~~system~~ as required by rules .04(3)(h)7.(i), .05(1)(a)3., and .05(3)(a).

RECORDKEEPING

Upon transfer of ownership, including, but not limited to, sale of the UST systems, originals and/or copies of all documents required to satisfy the reporting and recordkeeping requirements shall be transferred to the new owner of the USTs at the time of ownership transfer. See rule .03(2)(d).

The owner/operator should receive the SIR analysis no later than ten (10) days after the end of the reporting period as required by rule .04(3)(h)2. The owner/operator must retain the last twelve months of SIR results as required by rule .03(2)(b)4. and .04(5)b. A monthly report consisting of the inventory record used (raw data) plus the resulting SIR determination must be maintained by the owner/operator operator as required by rule .04(3)(h)2.(i). Inventory data must be analyzed at least every month as required by rule .04(3)(h)2. Failure to submit raw data for SIR analysis on a monthly basis is not monthly release detection and will not be acceptable to the Division.

The Division does not currently require the use of a specific form for reporting SIR results, so there may be some variation in appearance of SIR reports. Some SIR reports may include a summary sheet as part of the records. Monthly SIR reports must contain, as required by rule .04(5), the following at a minimum to be in the format established by the Division and in accordance with instructions provided by the Division :

1. Facility Information;
2. Owner Information;
3. Name of SIR method and version used;
4. Name, address, and phone number of SIR provider;
5. Date of report generation and month being analyzed;
6. Tank Information (tank number, capacity, contents);
7. The minimum detectable leak rate and calculated leak rate for the data set (for quantitative methods);
8. The number of days analyzed;
9. A result that is either 'Pass', 'Fail', or 'Inconclusive'; and
10. Raw data (daily stick readings to one-eighth inch and converted to gallons, deliveries, sales, reconciliation with book value, daily variances, water readings, etc.)

See the following example of an acceptable report

SIR RESULT SAMPLES

The following illustrate some SIR results and remarks for each.

Example 1

001		SIR Monthly Tank Evaluation Report				Date of Report: 07/11/2008				
FACILITY NAME						ID#:				
TANK LOCATION		Avenue				Tel:				
TANK OWNER LOCATION		TN				Tel:				
TANK OPERATOR		FL				Tel:				
SIR Provider										
SIR Version		V1.0				<ID: Site Dir:				
Period Covered		06/08 Fixed Threshold				23 usable days per month required.				
T A N K										
Tank ID.	Product	Max. SIR size (gal)	Size (gal)	Current Month			05/08 04/08			
				Leak Thres-hold (gph)	MDL rate (gph)	Calc. Leak rate (gph)	Pass, Fail, or Inconclusive	P F I	P F I	P F I
Unlead	REGULAR	45 K	10152	0.100	0.036	0.026	X		X	
Midgrade	MIDGRADE	45 K	10152	0.100	0.015	-0.022	X		X	
Premium	PREMIUM	45 K	10152	0.100	0.031	-0.030	X		X	

This is a SIR Summary Report. Notice the amount of information contained in this report although this report does not show the raw data used. The location information, SIR vendor information, size and product grade, the leak threshold being used, MDL and calculated leak rates and SIR result are all shown. This report also indicates the SIR version used by the vendor and the minimum number of usable days required by the vendor. The MDL for these data are all below 0.2 gph, so the calculated leak rates are valid. The calculated leak rates are compared with the leak threshold to determine the SIR result.

Example 2

Company : .			Location:			
Tank ID :			Product : UNLEADED			
Period : 01/26/08 - 03/30/08						
Dates	Sales	Receipts	Book	Closing Stick	Daily O/S	Cumulative O/S
01/26/08	1015.3	0.0		3643.0		
01/27/08	193.7	0.0	3449.3	3456.0	6.7	6.7
01/31/08	1126.3	0.0	2329.7	2373.0	43.3	50.0
02/04/08	1077.9	0.0	1295.1	1246.0	-49.1	0.9
02/05/08	254.3	0.0	991.7	973.0	-18.7	-17.8
02/06/08	288.9	0.0	684.1	659.0	-25.1	-42.9
02/10/08	1123.2	5000.0	4535.8	4529.0	-6.8	-49.7
02/13/08	752.7	0.0	3776.3	3800.0	23.7	-26.0
02/17/08	1050.2	0.0	2749.8	2769.0	19.2	-6.8
02/19/08	557.0	0.0	2212.0	2187.0	-25.0	-31.8
02/20/08	596.6	0.0	1590.4	1596.0	15.6	-16.2
02/21/08	327.3	0.0	1278.7	1220.0	-58.7	-74.9
02/25/08	1441.6	5006.0	4784.4	4840.0	55.6	-19.3
02/26/08	193.3	0.0	4646.7	4744.0	97.3	78.0
02/29/08	951.5	0.0	3792.5	3771.0	-21.5	56.5
03/02/08	414.3	0.0	3356.7	3327.0	-29.7	26.8
03/04/08	579.6	0.0	2747.4	2689.0	-58.4	-31.6
03/06/08	630.5	0.0	2058.5	2138.0	79.5	47.9
03/09/08	924.9	0.0	1213.1	1108.0	-105.1	-57.2
03/10/08	408.9	0.0	699.1	820.0	120.9	63.7
03/11/08	422.7	0.0	397.3	285.0	-112.3	-48.6
03/12/08	136.3	3450.0	3598.7	3800.0	201.3	152.7
03/14/08	253.5	0.0	3546.5	3565.0	18.5	171.2
03/16/08	712.1	0.0	2852.9	2689.0	-163.9	7.3
03/19/08	775.8	0.0	1913.2	1907.0	-6.2	1.1
03/22/08	851.7	0.0	1055.3	1040.0	-15.3	-14.2
03/23/08	145.9	0.0	894.1	949.0	54.9	40.7
03/25/08	522.4	0.0	426.6	332.0	-94.6	-53.9
03/27/08	325.2	3454.0	3460.8	3466.0	25.2	-28.7
03/30/08	859.2	0.0	2626.8	2819.0	192.2	163.5
<hr/>						
Number of Days Submitted:		30	Absolute Average O/S :			58.1
Minimum Daily Sales :	136.3		Minimum Product in Tank:			285.0
Maximum Daily Sales :	1,441.6		Maximum Product in Tank:			4,840.0
Average Daily Sales :	630.4		Number of Deliveries :			4
Total Product Sold :	18,912.8		Total Product Delivered:			16,910.0

TANK & LINES: PASS LEAK RATE: 0.095 MDL: 0.196 THR: 0.100

Even though this SIR report issues a PASS for this tank, notice the period covered: January 26 – March 30. There are many missing days in this 65-day period covered by the data. January 26 and 27 were weekend days and the next day sales readings are recorded was January 31, which was Thursday. It is unlikely the location was closed during those days. There are large variations in sales figures when there are missing days. This indicates that product levels are not being measured daily. Notice the MDL is almost above 0.2 gph and the calculated leak rate is .095 gph. Even though this data has been declared a “pass”, it is extremely close to being a SIR “fail”. If this result is for the month of March, the SIR vendor had to go back to January to get enough days to do the analysis since there were only 15 days of data for March. **In this example, even though the results indicate a “pass”, the tank owner/operator is not conducting SIR properly; therefore the results would not be accepted by the Division since he is not measuring product levels daily.**

Results of each SIR analysis must be reported following rule .04(3)(h)4, as either “Pass”, “Fail”, or “Inconclusive”, which are defined as:

PASS: If the calculated leak rate does not exceed the predetermined value of 0.10 gallons per hour (gph) and the minimum detectable leak in the monthly data does not exceed 0.20 gph and the number of valid daily readings is equal to or greater than the number required for a valid result as certified in the Third Party evaluation, the results may be reported as a “Pass”;

FAIL: If the calculated leak rate exceeds the predetermined value of 0.10 gph and the minimum detectable leak in the monthly data does not exceed 0.20 gph, the results shall be reported as a “Fail”;

INCONCLUSIVE: An “Inconclusive” result may be reported if any of the following conditions exist:

- If a leak rate cannot be calculated using the available data; or
- there is an insufficient number of usable days in a 30-day period* for a vendor to make a determination within the 95% Pd and 5% Pfa certification limits; or
- the minimum detectable leak (MDL) rate for the dataset for the month exceeds 0.2gph, or
- the SIR result is a “gain” or indicates a “gaining trend” that does not exceed the predetermined value of 0.10 gph, and this result is not due to measurable water incursion**

*If there is a lack of usable days in a 30-day period, the vendor may issue an inconclusive for the month, however, ~~Division rules~~, ~~-.04(3)(h)6.~~ requires another method of leak detection to be used for that month.

** If the gain **exceeds** the predetermined value of 0.10 gph, or **is due to measurable water incursion**, then it must be reported as a **'fail'** following rule .04(3)(h)4.(ii) and the appropriate procedures followed.

If a monthly report indicates an inconclusive result, then the owner/operator shall immediately implement the SIR vendor's investigative procedure for determining the cause of the inconclusive result as required by rule .04(1)(a)2. If the reason for the inconclusive results from a mechanical problem, such as meter miscalibration, then the tank owner must immediately correct the problem. If the next **consecutive** month's SIR result is also inconclusive, then the tank owner must report this to the Division as a suspected release within seventy-two (72) hours of receiving the SIR report, **as required by rules .04(3)(h)7. and rule .05(1)(a)3.**, and follow the procedures outlined in the **REPORTING** section below.

REPORTING

The tank owner is required to report the following conditions as a suspected release to the Division within 72 hours:

- Any monthly SIR result which is a "Fail" **under rule .04(3)(h)7.(i)**, or
- Any second consecutive month in which any tank received an "Inconclusive" SIR result **under rule .04(3)(h)7.(ii)**, or
- Unexplained or recurring presence of water in the tank **under rule .05(1)(a)2.**

REFERENCES

Tennessee UST Rules, Chapter ~~4200-01-15~~0400-18-01-.01 et.seq

Introduction To Statistical Inventory Reconciliation For Underground Storage Tanks, EPA 510-B-95-009, September 1995

Standard Test Procedures for Evaluating Leak Detection Methods: Statistical Inventory Reconciliation Methods, EPA/530/UST-90/007, June 1990

Protocol for Determining Applicability of a SIR Method for Manifolded Tanks and Determining Size Limitation, Developed under coordination by the SIR team of the National Work Group on Leak Detection Evaluations, November 1996

APPENDIX 1 SIR Vendor/ Method Quick Reference Guide

APPENDIX 1
SIR Vendor/ Method Quick Reference Guide

Manufacturer/ Vendor	Model	Threshold	Data Days	Single Tank Capacity	Manifolded Aggregate Tank Capacity
Advanced Telemetrics	Tanknetics SIR Version 2.1	0.1 0.05	28	45,000	4 Tank maximum =<45,000
Clearstone Engineering, Ltd	GreenScan SIR 3.0.1.2	0.1 0.05	30	30,000	4 Tank maximum =<45,000
Computerizing, Inc.	Computank Version 3.0	0.05	30	18,000	not evaluated for manifolded tanks
Entropy LTD (purchased by Veeder Root)	PTIC Rev. 90-12/93	0.05	30	60,000	60,000
EnviroSIR, LLC	EnviroSIR Version 1.0	0.1 0.05	28	45,000	4 Tank maximum =<45,000
Horner Products, Inc. (company no longer in business)	Horner SIR PRO 1 V3.0	0.1 0.16	23	45,000	4 Tank maximum =<45,000
	Horner SIR PRO 1 V4.0	0.05	30	33,000	not evaluated for manifolded tanks
Leighton Obrien Technologies, Ltd.	Monitor/ Redone	0.05	26	33,675	5 Tank maximum =<60,000
Simmons Corporation	Simmons SIR 5.7 L.M.	0.1	27	60,000	5 Tank maximum=<60,000
	Simmons SIR 5.7	0.05	30	18,000	not evaluated for manifolded tanks
SIR International, Inc.	Mitchell's SIR Program V 2.6	0.05	23	45,000	4 Tank maximum =<45,000
	Mitchell's SIR Program V 2.7	0.1	23		
SIR Monitor	SIR Monitor	0.05	90, then 30	18,000	not evaluated for manifolded tanks
SIR Phoenix	SIR Phoenix	0.05	90, then 30	18,000	not evaluated for manifolded tanks
	SIR Phoenix, LEOMA V 01.50	0.1	28	18,000	4 Tank maximum =<45,000
Syscorp, Inc.	Store Vision, Version E. 2	0.0834	29	12,000	not evaluated for manifold tanks
TeleData Inc.	TankMate SIR V3.2	0.05	15	60,000	3 Tank maximum =<60,000

TotalSIR, LLC	TotalSIR Version 1.0, 2.0	0.1	23	45,000	4 Tank maximum =<45,000
USTMAN (owned by Gilbarco-Veeder Root)	YES SIR 90	0.1	30	15,000	not listed for manifold tanks
	USTMAN Ver. 94.1	0.05	30	30,000	not listed for manifold tanks
	USTMAN SIR Ver 95.2	0.05	30	60,000	4 Tank maximum =<60,000
	USTMAN 95.2A	0.1			
	USTMAN 95.2B	0.16			
Warren Rogers Associates	PetroNetwork S3 vD CITLDS	0.1	6 to 31	100,000	5 Tank maximum =<100,000 Monthly throughput 2,718,000
	WRA SIRA System V. 5.2	0.1	30	36,000	3 Tank maximum =<36,000
	WRA SIRA System V. 5.1	0.05	30	18,000	not evaluated for manifold tanks
Watson Systems, Inc. (now owned by Veeder Root)	Watson SIRA V2.0., 2.8.3	0.1	30	30,000	not evaluated for manifold tanks